SUPPLEMENTARY MATERIALS FOR

The Interplay of Attention and Emotion: Top-down Attention Modulates Amygdala Activation in Psychopathy

Christine L. Larson, Ph.D.[1], Arielle R. Baskin-Sommers, M.S.[2], Daniel M. Stout, M.S.[1],

Nicholas L. Balderston, M.S.[1], John J. Curtin, Ph.D.[2], Douglas H. Schultz, M.S.[1], Kent A. Kiehl,

Ph.D.[3], and Joseph P. Newman, Ph.D.[2]

[1]University of Wisconsin-Milwaukee, [2]University of Wisconsin-Madison, [3]Mind Research

Network and University of New Mexico

Group Comparisons of Amygdala Activation for Each Condition

Rationale and Approach

As stated in the *Methods* section, based on the previous fear-potentiated startle findings (Baskin-Sommers et al., 2011), our primary hypothesis regarding amygdala activation was that psychopaths would not differ from nonpsychopaths for any condition, except the Early Alternative Focus condition. Thus, we modeled our analysis strategy directly on that used in the Baskin-Sommers et al. (2011) study. Consistent with the Helmert contrasts reported in that paper, amygdala activation for the two groups was compared for Early Alternative Focus vs. the average of the three remaining conditions (Early Threat Focus, Late Alternative Focus, Late Threat Focus). Here, we present additional analyses in which group differences in amygdala activation are tested separately for each of the four conditions.

Given the strong interest in amygdala deficits in psychopathy, we present the most liberal tests of group differences, whole brain voxel-wise t-tests comparing the two groups for each of the four conditions. This was done rather than masking the activated clusters using significant voxels from the Group X Condition ANOVA in order to determine whether there were significant group differences in any regions of the amygdala for any of the four conditions.

Results

As predicted by the attention bottleneck hypothesis, in the Early Alternative Focus condition psychopaths exhibited significantly less activation than nonpsychopaths in a cluster including the right dorsal amygdala and substantia inominata (SI)(see panels A and B in Figure on next page; uncorrected $p = .001$; peak: x = 19, y = -7, z = -9). Also consistent with the attention-based predictions, there was no evidence of a deficit in amygdala activation for psychopaths compared to nonpsychopaths in the between groups t-tests for the Early Threat (C; $p = .27$), Late Threat ($p = .98$), and Late Alternative Focus ($p = .47$) conditions, respectively (all ps are uncorrected).

These findings mirror those presented in the main manuscript, indicating that psychopaths' deficits in amygdala recruitment in response to threat are specific to conditions in which attention is already engaged in a competing goal-directed task.
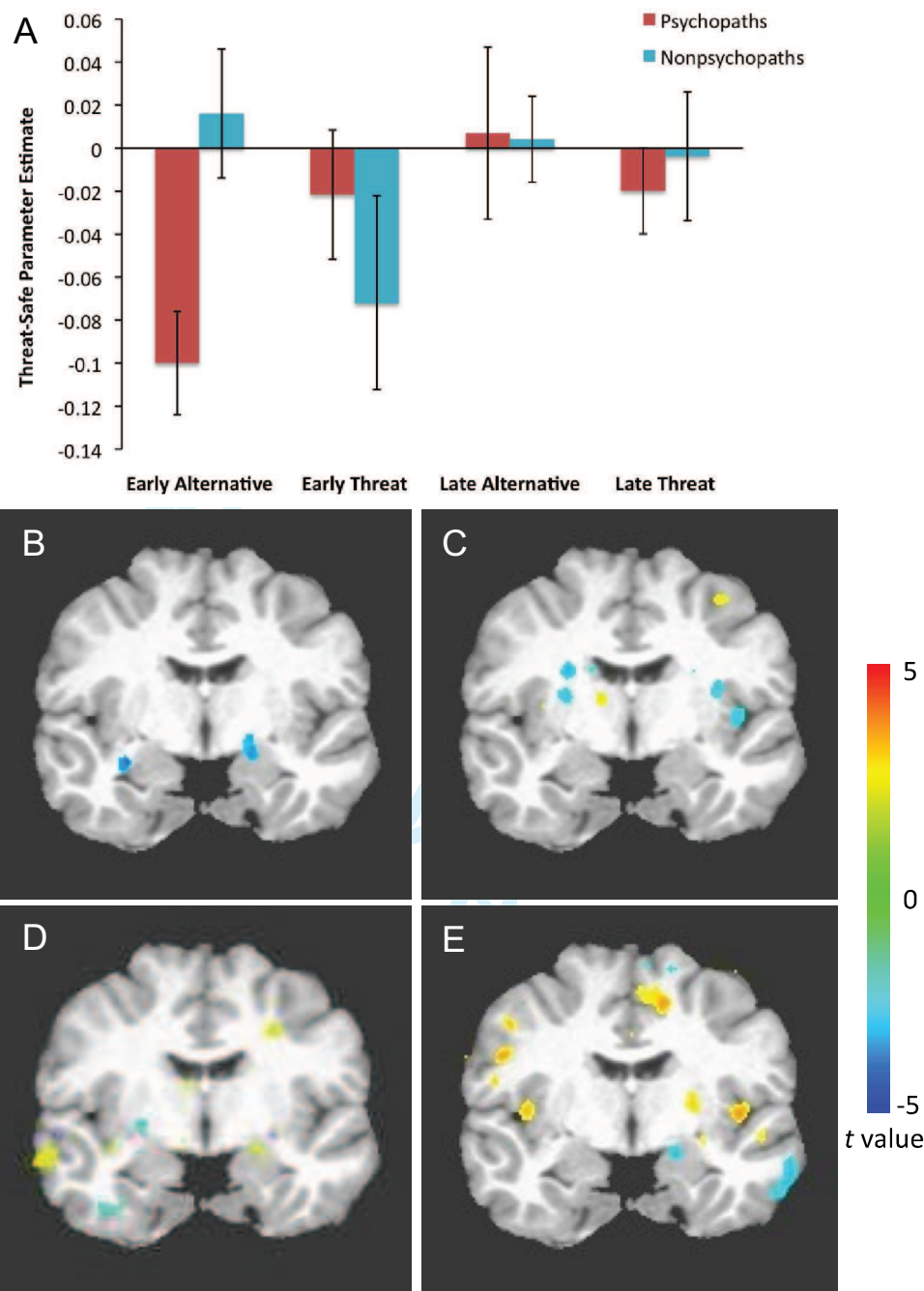
The bar graph (A) depicts mean threat minus safe percent signal change for each condition based on the amygdala/SI cluster demonstrating a significant group difference for the Early Alternative Focus condition. Error bars represent standard error of the mean. The brain images in the middle panel depict between groups comparisons for Early Alternative (B) and Early Threat Focus (C). As can be seen in the brain image (B), during Early Alternative Focus trials decreased activation in psychopaths compared to nonpsychopaths was present in the right dorsal amygdala, extending to the SI. No significant voxel-wise group differences were observed for Early Threat (C), Late Alternative, or Late Threat Focus Conditions. Within groups paired comparisons are presented in the bottom panel. Psychopaths showed greater right amygdala activation for Early Threat compared to Early Alternative Focus trials (D). In contrast, amygdala activation for nonpsychopaths was greater for Early Alternative compared to Early Threat focus (E). No within-group differences were observed for the Late Alternative or Threat Focus trials. For all brain images y = -7.

References

Baskin-Sommers, A. R., Curtin, J. J., & Newman, J. P. (2011). Specifying the attentional

selection that moderates the fearlessness of psychopathic offenders. *Psychological

Science, 22*(2), 226-234. doi: 10.1177/0956797610396227